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(54) Abstract Title
Production of edible foams

(57) A capsule for the preparation of an edible foam comprising: side walls 2,3 defining an enclosed region containing a foamable ingredients 6; an inlet 7 for injecting a liquid into the said region; and an outlet 5 for allowing liquid to escape from the said region, wherein at least one of the said inlet and outlet comprises a constriction (10, fig 3) for providing a liquid jet having a diameter of from about 0.5 to about 2 mm. Typically the foamable ingredient comprises a partially or completely dehydrated dairy or non-dairy beverage whitener used for cappucino or latte. Outlet 5 may have a freshness barrier breakable by water pressure or an adhesive 8 meltable by hot water. Inlet 7 may comprise a disposable nozzle bonded to side walls 2,3.

FIG. 2

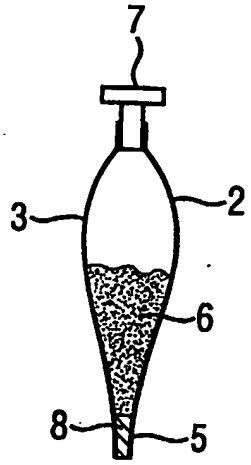

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FIG. 1

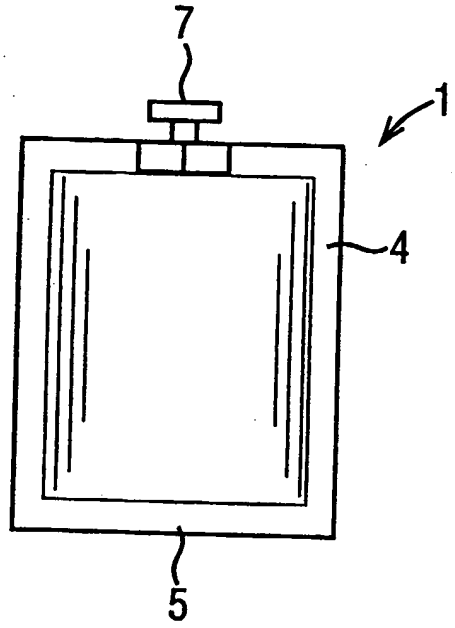


FIG. 2

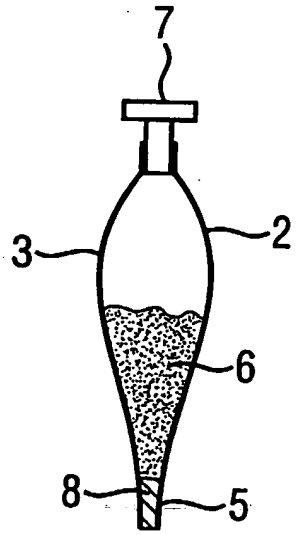
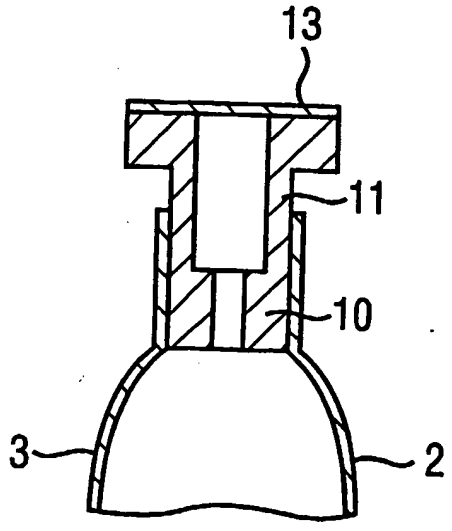


FIG. 3



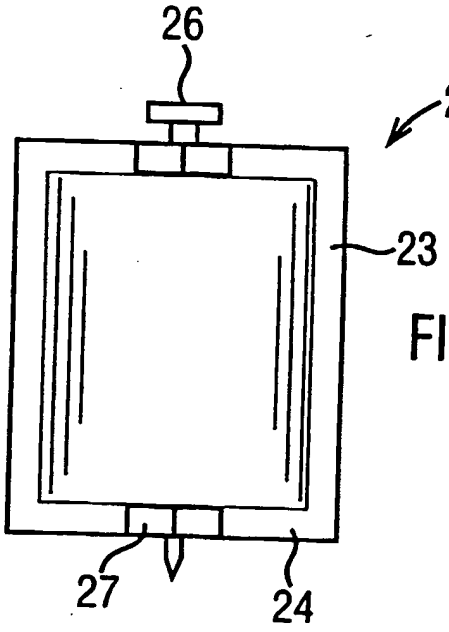


FIG. 4

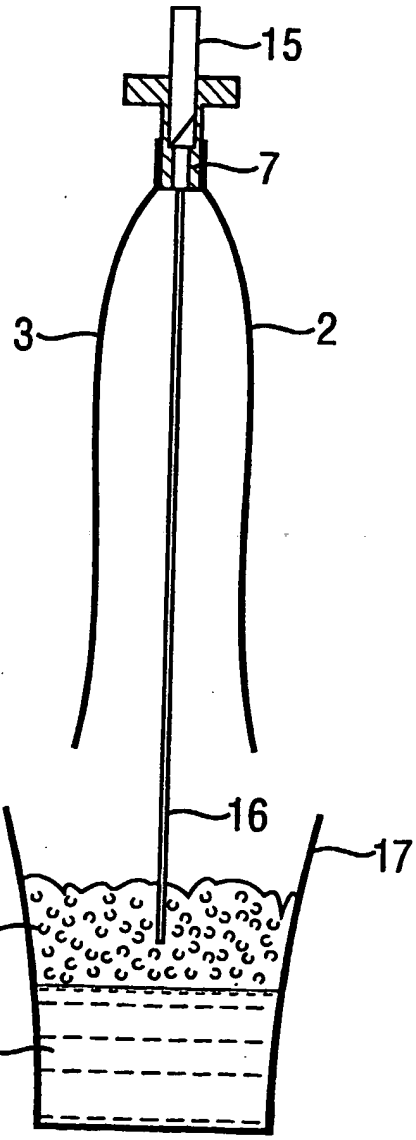


FIG. 5

PRODUCTION OF EDIBLE FOAMS

The present invention relates to methods of production of edible foams, and to packages containing foamable ingredients for use in such methods.

It is known to form edible foams from fresh milk, for example in milk shakes. It is also known to serve coffee and other hot beverages with a layer of hot milk foam over the liquid beverage. The hot milk foam is traditionally made by injecting steam under pressure through a hollow steam wand into cold fresh milk to heat and foam the milk. The milk foam is then poured onto liquid coffee to form the beverage, for example cappuccino or latte.

The milk foaming is normally carried out separately from the coffee brewing, because the essential oils present in coffee have a deleterious effect on foaming.

The traditional method of forming hot milk foam for cappuccino or latte does not lend itself to use in beverage vending installations. This is in part because fresh or liquid milk is difficult to handle in such installations. Furthermore, most vending installations are not equipped to supply steam under pressure. In addition, the use of a steam wand immersed in the liquid milk would present cross-contamination problems.

It is known to provide a powdered beverage whitener containing encapsulated nitrogen gas that produces a foam when it is dispersed in coffee. However, the foam does not have the same bulk and stiffness (spoonability) as a conventional cappuccino foam.

It is also known to produce a foam in a vending machine by depositing a powdered milk into a cup, followed by jetting hot water into the cup to dissolve the powdered milk and foam the milk by the action of high shear between the water jet and the milk. This suffers from the reduced consumer acceptability and mess associated with depositing a powdered milk into the cup. Furthermore, the milk powder may not dissolve completely. In order to achieve more complete dissolution of the

powder it is necessary to move the jet relative to the cup by means of an X-Y table or similar equipment, thereby increasing the cost of the apparatus.

US patent 2,977,231 describes pressurised packages containing liquid concentrates, especially for the production of milkshakes. The packages have a discharge orifice of diameter about 1.3 to 2.4 mm (0.05 inch to 0.09 inch) and are pressurized to about 500kPa (75 pounds). The resulting narrow, high speed jets achieve effective mixing and foaming through shear forces when injected into an aqueous liquid.

US patent 3,622,354 describes packages similar to those of US 2,997,231, but with the viscosity of the liquid concentrate in the package controlled so as to enable satisfactory mixing and foaming to be achieved with a nozzle diameter of about 3 mm. This enables the package to be dispensed more quickly.

EP-A-0885154 describes a dispensing device for the preparation of a foamy beverage. The device contains a milk concentrate and is pressurised to 900-1000 kPa (9-10 bar) with an orifice diameter of at most 1 mm. The resulting very high speed jet of the concentrate gives effective mixing and foaming of the concentrate when it is injected into a liquid beverage.

It is an object of the present invention to provide foamy beverage producing systems that are suitable for use in vending installations, such as automated vending machines.

It is a further object of the present invention to provide foamy beverage producing systems that give stiff, stable foams comparable to those obtained by the traditional steam wand methods.

It is a further object of the present invention to provide foamy beverage producing systems that are hygienic, preferably with minimal cross-contamination between brews.

It is a further object of the present invention to provide foamy beverage producing systems that require minimal adaptation of existing beverage vending equipment, and in particular avoid the need for high pressures or steam injection.

In a first aspect, the present invention provides a capsule for the preparation of an edible foam comprising: side walls defining an interior region containing a foamable ingredient; an inlet for injecting a liquid into the said region; and an outlet for allowing liquid to escape from the said region , wherein at least one of the said inlet and outlet comprises a constriction for providing a liquid jet having a diameter of from about 0.5 to about 2 mm.

Normally, the edible foam forms part of a foamy beverage. The foamable ingredient may be any food-acceptable ingredient that forms a foam on high-shear mixing with water, for example milk products, chocolate or other beverage ingredients such as coffee. Typically the foamable ingredient comprises a partially or completely dehydrated dairy or non-dairy beverage whitener, such as a milk . In certain embodiments, the foamable food ingredient is substantially anhydrous for ease of handling and maximum storage stability. Various milk powders are suitable, and the fat content and other characteristics of the milk powder can be optimised for each case. The milk powder may form part of a hot chocolate drink. Preferably, the foamable food ingredient consists essentially of a granulated dried milk or a spray dried milk powder, optionally fat reduced. In certain embodiments the ingredient comprises an instantised milk granulate.

The dry weight of the foamable ingredient may typically be from about 1 to about 50g, preferably from about 2 to about 15 grams, more preferably from about 5 to about 12 grams. In other words, the amount of the ingredient in each package is preferably sufficient for one portion of the foamed product, e.g. one cup of a foamy beverage.

Preferably, the package is substantially shelf stable. That is to say, it may be stored at ambient temperature and atmospheric conditions for a period of at least 3 months, preferably at least one year, without deterioration.

The capsule is normally formed of thermoplastic material, and is disposable after one use. The capsule may comprise at least one side wall formed from a substantially rigid sheet material. For example, capsules having substantially cylindrical shapes are envisaged. More typically the capsule comprises a side wall formed from flexible film material, for example a tubular sachet formed on a form-fill-seal machine, or a body formed by bonding together front and back sheets of film material around the edges thereof to define a sachet. The capsule will normally be substantially air and moisture impermeable before use in order to preserve the food ingredient in a shelf stable condition.

In certain embodiments the internal volume of the capsule is from about 25 to about 100 cm^3. The internal volume refers to the maximum volume of the capsule when fully distended. This internal volume is typically at least twice the volume of the foamable ingredient, in order to allow space for turbulent flow and mixing of the aqueous liquid with the ingredient in the capsule.

The inlet or outlet is adapted to provide a narrow diameter liquid jet into the interior of the capsule, and/or out of the interior of the capsule in use. The resulting high shear mixing when the jet hits a liquid surface containing the fomable ingredient results in foam formation.

Preferably, the constriction provides a jet having a diameter of from about 0.7 to about 1.5 mm, more preferably about 1 mm.

In certain embodiments the capsule may comprise two or more jet-forming inlets or outlets in order to combine high shear with an increased liquid flow rate. The two or more inlets may be connected through a manifold to a single liquid inlet duct. At least one of the inlets may be angled to assist swirling and washing out of the capsule.

The internal cross-section of the jet-forming inlet or outlet is normally a regular shape, and preferably it is substantially circular. Since aqueous liquids are substantially incompressible and not significantly viscoelastic, it follows that the

internal cross sectional area of the jet-forming region of the inlet and/or the outlet is generally from about 0.2 to about 3 mm^2, preferably from about 0.4 to about 2 mm^2, for example about 1 mm^2.

If the constriction (narrow bore, jet forming region) of the inlet or outlet is too short, then the inlet or outlet tends to form a spray rather than a jet. If the constriction is too long, then the pressure drop across the constriction may be too high. Accordingly, the constriction preferably extends for a distance of from about 1 to about 5 mm, preferably about 2 to about 4 mm along the direction of liquid flow.

In certain embodiments the jet forming region of the inlet or outlet may comprise a disposable nozzle. The nozzle may be formed by injection moulding of plastic material and may be inserted in liquid-tight fashion into a seal between front and back sheets of film material making up the capsule, substantially as described in EP-A-0179641 or WO-A-9905036. In these earlier documents the bore area of the nozzle was substantially greater than $3mm^2$ in order to provide rapid flow of liquid into the sachets. The nozzle in the capsules according to the present invention may comprise an inlet duct of diameter about 3mm or more for compatibility with existing beverage brewing machines, but the exit from the nozzle may have a constricted cross-section to form a jet as hereinbefore described. The disposable inlet or outlet nozzle provides the advantage that it does not get blocked by scale or contaminated by prolonged use.

The capsule according to the invention generally operates by enabling, first, turbulent mixing of the aqueous fluid and the foamable ingredient in the capsule, followed by jetting aqueous fluid directly into the mixture in the receptacle to provide further foaming. The use of a capsule removes earlier problems with incomplete dissolution of solids in the receptacle.

In certain embodiments the outlet is sealed by freshness barrier. The term "freshness barrier" refers to a barrier that is substantially impermeable to air or moisture so as to preserve the freshness of the beverage brewing ingredient by preventing ingress of air or moisture through the liquid guide before brewing

commences. The freshness barrier may be released by an external mechanical force or thermal field applied during brewing. The freshness barrier is preferably releasable by the action of pressure and/or hot water from inside the sachet during brewing. For example, the freshness barrier may comprise a layer of a sealant that is released by the action of heat and/or moisture, such as an adhesive as described in EP-A-0179641 or WO99/05036.

In certain embodiments of the invention, the constriction is provided in the inlet. The constriction results in a jet of the aqueous fluid, typically water, being injected into the capsule, where it initially disperses the foamable ingredient. In such embodiments, the outlet may be located substantially opposite to the inlet. An advantage of the outlet being located opposite the inlet is that the jet from the inlet can clear blockages of the outlet caused by incompletely dispersed foamble ingredient.

In certain other embodiments, the jet forming constriction is provided in the outlet only. An advantage of such embodiments is that the outlet nozzle can be angled to swirl the liquid in the receptacle. However, these embodiments are not preferred, since the outlet is then prone to blocking by particles of the foamable material. Preferably, the capsule comprises either a jet-forming outlet situated opposite to a jet forming inlet, as described above, or a large outlet situated opposite to a jet forming inlet, as follows.

In the large-outlet embodiments the outlet is adapted to provide, in use, an opening having a cross sectional area preferably greater than about 1 cm^2, whereby a jet of water issuing from the inlet can pass through the capsule and out of the opening substantially without touching the side walls of the capsule. The jet then impacts the liquid in a receptacle below the capsule to cause foaming.

Preferably, the outlet is sealed by a freshness barrier as hereinbefore described, so that the injection of water into the capsule initially causes mixing with the foamable food ingredient. The freshness barrier is then released to form said

opening, whereby releasing the food ingredient into the receptacle, followed by further water injection, produces foam in the receptacle.

For example, in certain embodiments the capsule comprises two flexible sheets bonded together along a seam situated opposite the inlet, said bonding being releasable by the action of heat or pressure inside the capsule, whereby the two sheets peel apart under said action to provide said opening.

In a second aspect the present invention provides a method of preparing an edible foam comprising the steps of: providing a capsule according to the invention; injecting an aqueous liquid under pressure into the inlet; allowing the foamable food ingredient to mix with the aqueous liquid in the capsule; followed by allowing the aqueous liquid to escape through the outlet of the capsule and into a receptacle as a high velocity jet.

Preferably, the aqueous liquid consists essentially of water, optionally mixed with steam. In certain embodiments the aqueous liquid is injected at a pressure of from about 30kPa (0.3 bar) to about 200kPa (2 bar). These pressures are lower than previously known jet foaming methods, and are suitable for use in vending equipment without special measures. In other embodiments the aqueous liquid is injected at pressures of from about 200 kPa to about 2MPa (about 2 to about 20 bar), preferably from about 200kPa to about 500kPa (about 2 to about 5 bar). These pressures are conventionally generated for brewing espresso coffee.

In certain preferred embodiments the aqueous liquid is injected in a two stages: a first relatively low pressure stage to achieve mixing with the foamable ingredient without bursting the capsule, followed by a second, high pressure stage to provide a high velocity jet for foaming.

Preferably, the aqueous fluid is injected into the capsule by a peristaltic or piston pump, preferably at an average rate of from about 250 to about 2000 ml/min and more preferably from about 500 to 1500 ml/min. The aqueous fluid may be injected in intermittent or pulsed fashion to optimise the amount of foam or the

organoleptic properties of the product. In certain embodiments the method further comprises the step of injecting air into the capsule after injecting the liquid to expel residual liquid from the capsule.

In certain embodiments the total amount of aqueous liquid injected is from about 25 ml to 200ml. This is sufficient to produce from about 20 ml to about 500ml of foamed product. For a hot foamed beverage the temperature of the aqueous liquid is typically from about 75 to about 100 degrees C.

Typically the jet velocity of the aqueous liquid leaving the inlet nozzle (or the outlet nozzle, where present) is from about 5 to about 50 m/s, preferably from about 10 to about 25 m/s. This gives sufficient shear to provide effective foaming.

The receptacle is typically a cup, for example a polystyrene cup. Typically, the bottom of the receptacle is located from 5 to 25cm below the bottom of the capsule.

It is occasionally found that the method according to the invention produces a foam having undesirable large bubbles near the top. In such cases the method preferably further comprises the step of applying a water spray to the top of the foam in the receptacle after the step of water injection. The water spray disperses the larger bubbles.

In certain embodiments as described above the outlet of the capsule, when opened, provides a sufficiently large opening for the jet from the inlet nozzle to pass straight through. In other embodiments the outlet is constricted, for example where there is an outlet nozzle as described above. In cases where there is a constriction in the outlet, the pressure in the capsule builds up as a result of the inlet jet and there will be a risk of bursting the capsule. In such cases the method preferably further comprises the step of clamping the capsule in a clamp cavity before the step of injecting. The clamp cavity is configured with cavity walls that support the capsule to prevent it from bursting under pressure.

In a third aspect the present invention provides a system for brewing a beverage by a method according to the invention, the system comprising:

a beverage brewer having a capsule holder adapted to receive a capsule according to the present invention; and

a capsule according to the present invention.

The brewer preferably comprises an injector tube or tubes for injecting the aqueous fluid into the inlet nozzle when the capsule is held in the brewing cavity. Preferably, the apparatus further comprises a mechanism operatively associated with the capsule holder to retract the injector tube or tubes when the capsule holder is opened.

In certain embodiments the capsules according any aspect of the present invention may comprise machine readable pack recognition means on the capsule to assist use of the capsule in fully automated vending equipment. For example, the capsule may comprise machine readable projections or perforations or a bar code.

Specific embodiments of the present invention will now be described further, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 shows a plan view of a first capsule according to the present invention;

Figure 2 shows a longitudinal sectional view through the capsule of Figure 1;

Figure 3 shows a detail of the inlet nozzle region of the sectional view of Figure 2;

Figure 4 shows a plan view of a second capsule according to the present invention; and

Figure 5 shows a longitudinal sectional view through the capsule of Figure 1 in use.

Referring to Figure 1, the capsule 1 is in the form of a sachet formed from two sheets of laminated, metalised flexible plastic film 2,3 bonded together around a margin 4. A lower part 5 of the margin is bonded by means of a layer of adhesive 8 that can be released by the action of hot water inside the sachet. In a top part of the margin a nozzle 7 is inserted between the sheets 2,3 and bonded thereto in air

tight fashion. The capsule has an internal volume of approximately 50cm^3 when fully distended. Thus far the construction of the capsule 1 is similar to the beverage brewing sachets described in EP-A-0179641 or WO99/05036. However, the capsule 1 differs from the earlier sachets in that it is approximately half filled with approximately 9g of a foamable powdered milk 6, and also differs in the dimensions of the nozzle as described further below.

Referring to Figure 3, the inlet nozzle 7 is formed by injection moulding of a thermoplastic material such as polypropylene. It is bonded by adhesive or melt bonding in air tight fashion to the front and back sheets 2,3 of the sachet. The nozzle 7 comprises a narrow bore region 10 having a substantially cylindrical bore approximately 3mm long and 1mm in diameter. The nozzle 7 further comprises a relatively wide bore outer region 11 having an internal diameter of approximately 3mm, into which a water injection tube is inserted in use. A flange 12 is provided at the top of the nozzle to assist mechanical gripping and manipulation of the sachet in the brewing apparatus. Finally, a plastics laminated foil freshness barrier 13 is sealed over the top of the nozzle. This results in a fully air tight and moisture-tight package that is shelf stable.

In use, the package 1 is inserted into a beverage brewer (not shown), in which it is gripped by jaws 20 under the flange 12, as shown in Figure 5. A water injection tube 15 attached to the brewer is advanced until it pierces through the freshness barrier film 13 and forms a pressure-tight mating fit in the wide bore section 11 of the nozzle 7. Water at about 90°C and at an initial pressure of about 0.2 bar (20kPa) is injected through the nozzle and into the capsule , where it mixes with the powdered milk to form a concentrated milk dispersion. The hot water and pressure them release the adhesive bond 8 and the concentrated milk dispersion drops into the receptacle 17. This initial injection stage typically takes from 5 to 10 seconds, and the total amount of water injected in this stage is from 50 to 60 ml.

The water injection pressure is then increased to approximately 2 bar (200kPa), which causes the water to emerge from the narrow bore section 10 of the nozzle 7 as a high velocity jet having a diameter of approximately 1mm and a velocity of

approximately 15 m/sec. This high energy jet 16 impacts the fluid 18 present in the receptacle 17 with high shear mixing to produce a layer of foam 19. The water jet injection stage typically takes from 10 to 30 seconds, and the total amount of water injected is from 10 to 250 ml.

After the step of water injection is complete, the injection tube 15 is retracted, and the empty capsule is ejected into a waste receptacle. A water spray (not shown) is then briefly applied to the foam 19 in the receptacle 17 to disperse any large bubbles present at the top of the foam layer 19 to provide a stable, spoonable milk foam layer 19.

Referring to Figure 4, alternative capsule 22 also comprises front and back sheets of metal laminated flexible plastic sheet material bonded together around a margin 23. A nozzle 26 of similar construction to the nozzle 7 of the first embodiment is inserted in top region of the margin 23. An outlet nozzle 27 is inserted in a bottom region 24 of the margin. The nozzle 27 provides the sole outlet from the capsule, since the margin 24 is not releasable by the action of heat or water inside the capsule. The nozzle 27 is moulded from thermoplastics in similar fashion to the nozzles 26 and 7, and has a narrow bore adapted to provide an outlet jet of diameter about 1mm. A freshness barrier film is provided in the nozzle 27 that can be ruptured by pressure.

In use the package of Figure 4 is clamped tightly in a cavity having a clam shell configuration within the beverage brewer. The cavity encloses and supports the package and prevents it from bursting under the pressure of injected water. Water is injected into nozzle 26 initially at fairly low pressure as describe above in relation to the embodiments of Figure 1. The water mixes with the powdered milk in the sachet, and the pressure inside the sachet increases until the freshness barrier in the outlet nozzle 27 bursts, whereupon the mixture is ejected as a high velocity jet from the outlet nozzle 27. Water injection through the nozzle 26 is continued at high pressure to rinse out the capsule, clear any blockages in the outlet jet, and continue injection into the receptacle below the package to produce

a foam as previously described. The remaining steps of the process are as described above.

The above embodiments have been described by way of example only. Many other embodiments falling within the scope of the accompanying claims will be apparent to any skilled reader.

CLAIMS

1. A capsule for the preparation of an edible foam comprising: side walls defining an enclosed region containing a foamable ingredient; an inlet for injecting a liquid into the said region; and an outlet for allowing liquid to escape from the said region, wherein at least one of the said inlet and outlet comprises a constriction for providing a liquid jet having a diameter of from about 0.5 to about 2 mm.

2. A capsule according to claim 1 wherein the foamable ingredient comprises a partially or completely dehydrated dairy or non-dairy beverage whitener.

3. A capsule according to claim 2 wherein the foamable ingredient consists essentially of a partially or completely dehydrated dairy or non-dairy beverage whitener.

4. A capsule according to claim 3, wherein the foamable ingredient consists essentially of a foamable milk powder.

5. A capsule according to any preceding claim, wherein the dry weight of the foamable ingredient is from about 5g to about 50g.

6. A capsule according to any preceding claim, wherein the side walls are formed from flexible film material.

7. A capsule according to any preceding claim, wherein the capsule comprises a substantially cylindrical body.

8. A capsule according to any preceding claim wherein the outlet is sealed by a freshness barrier.

9. A capsule according to claim 8, wherein the freshness barrier can be released by the action of water or pressure inside the capsule.

10. A capsule according to any preceding claim, wherein the constriction has a substantially circular internal cross section.

11. A capsule according to any preceding claim, wherein the diameter of the liquid jet is from about 0.7 to about 1.5 mm

12. A capsule according to any preceding claim, wherein the constriction extends for a distance of from 1 to 5 mm along the inlet or the outlet.

13. A capsule according to any preceding claim, wherein the inlet or the outlet having said constriction comprises a disposable nozzle bonded to the side walls.

14. A capsule according to any preceding claim wherein the constriction is provided in the inlet.

15. A capsule according to claim 14, wherein the outlet is located substantially opposite to the inlet.

16. A capsule according to claim 14 or 15, wherein a further constriction is provided in the outlet for producing an outlet jet having a diameter of from about 0.5 to about 2 mm.

17. A capsule according to claim 16, wherein the constriction provided in the outlet is for producing an outlet jet having a diameter of from about 0.7 to about 1.5 mm.

18. A capsule according to claim 15, wherein the outlet is adapted to provide, in use, an opening having a cross sectional area greater than 1 cm^2, whereby a jet of water issuing from the inlet can pass through the capsule and out of the outlet substantially without touching the side walls.

19. A capsule according to claim 18, wherein the capsule comprises two flexible sheets bonded together along a seam situated opposite the inlet, said bonding being releasable by the action of heat or pressure inside the capsule, whereby the two sheets peel apart under said action to provide said opening.

20. A capsule according to any preceding claim, wherein the internal volume of the capsule is from about 25 to about 100 cm^3.

21. A method of preparing an edible foam comprising the steps of: providing a capsule according to any one of claims 1 to 20; injecting an aqueous liquid under pressure into the inlet; allowing the foamable ingredient to mix with the aqueous liquid in the capsule; followed by allowing the aqueous liquid to escape through the outlet of the capsule and into a receptacle as a high velocity jet.

22. A method according to claim 21, wherein the aqueous liquid consists essentially of water.

23. A method according to claim 21 or 22, wherein the aqueous liquid is injected at a pressure of from about 30 kPa (0.3 bar) to about 200kPa (2 bar).

24. A method according to claim 21, 22 or 23, wherein the total amount of aqueous liquid injected is from about 25 ml to 200ml.

25. A method according to any one of claims 21 to 24, wherein the jet velocity of the aqueous liquid leaving the capsule is from 5 to 50 m/s.

26. A method according to any one of claims 21 to 25, wherein the temperature of the aqueous liquid is from about 75 to about 100°C.

27. A method according to any one of claims 21 to 26, wherein the bottom of the receptacle is located from 5 to 25cm below the bottom of the capsule.

28. A method according to any one of claims 21 to 27, further comprising the step of applying a water spray to the top of the foam in the receptacle after said step of injecting is completed.

29. A method according to any one of claims 21 to 28, further comprising the step of gripping the capsule in a capsule holder before the step of injecting.

30. A system for preparing an edible foam by a method according to any one of claims 21 to 29, the system comprising:

a beverage brewer having a capsule holder adapted to receive a capsule according to any one of claims 1 to 20; and

a capsule according to any one of claims 1 to 20.

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Application No: GB 0110421.5 **Examiner:** Darren Handley
Claims searched: 1-30 **Date of search:** 9 October 2001

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): B8K (KFB)

Int Cl (Ed.7): B65D 81/00

Other: Online: WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
A	EP 0179641 A2	(MARS) - see page 3, line 21- page 4, line 3 and page 5, line 2, - page 6, line 10.	
A	WO 99/05036 A1	(MARS) - see page 3, line 18- page 4, line 4.	
A	WO 99/05045 A1	(MARS) - see page 3, lines 8-30.	
A	WO 99/05044 A1	(MARS) - see page 3, line 12- page 4, line 6.	
X, P	WO 01/58786 A1	(KRAFT) - see page 1, lines 1-8, page 6, line 35- page 7, line 18 and page 10, line 2-page 12, line 5.	1, 2, 5, 10, 11, 20-22, 24-26, 29, 30

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.